Space Astronomy Laboratory
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January 24, 1966

Mr. J. T. Holloway, Acting Director
Office of Grants and Research Contracts
Office of Space Science and Applications
National Aeronautics and Space Administration
Washington, D. C. 20540

Subject: Interim Report on NsG-618

Dear Mr. Holloway:

In accordance with NASA policy regarding the administration of research grants, we are submitting the required technical [redacted] report for the period of April 1, 1965 through September 30, 1965.

Aerobee Hi Sounding Rocket

Analysis of photometric measurements of stars made on Aerobee 4.55 indicate that for spectral types B2 to A5 model atmospheres (e.g. those of Strom and Mihalas) represent well the continua of stars over the near ultraviolet to 2000 A. In particular no differences greater than $\pm 0^m.5$ were found between observations and the models for

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.....and no indication of any ultraviolet deficiency setting in at 2500 A and extending to shorter wavelengths was found. Since the errors in the photometry and calibration are thought to be $\pm .0^m.5$, such agreement is satisfactory.

Observations of Saturn also made on this flight suggest a albedo in the ultraviolet (0.6 at 2800 A) increasing slightly towards shorter wavelength. This result is not as reliable as the stellar observations since the deflections were rather poor. However, a similar albedo was recently reported for Jupiter.

These results were presented at the Ann Arbor meeting of the American Astronomical Society in August, 1965.

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Photometric Studies

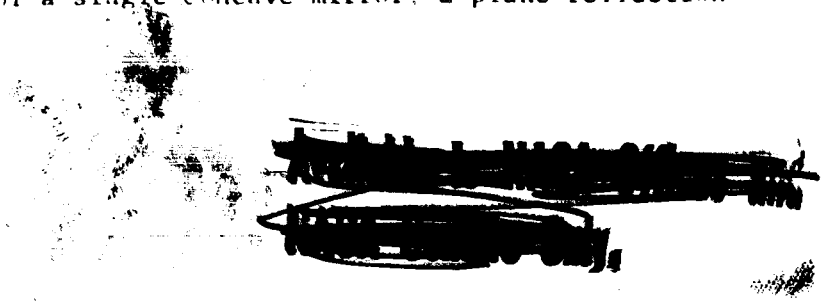
Using a newly-developed technique for determining the variation in sensitivity across the photocathode, iso-sensitivity profiles have been obtained for approximately 140 photomultipliers. The data obtained is currently under analysis to determine generic trends for various tube types. Relative cathode sensitivities have been determined for approximately 80 circular cage type photomultipliers (1PH, 931, 1P28, etc.) with manufacture dates extending back as far as 1946. Preliminary results indicate neglible statistical difference between cathode sensitivities of tubes nearly 20 years old compared to modern versions of the same type, indicating rather long term stability for the S-4 cathodes. These tubes are currently being examined for total amplification, dark current and stability. During an informal conference at RCA, production techniques for the tubes under investigation were observed. Plans are underway for obtaining "partical-detector" versions of the same circular cage type multipliers (i.e. identical types without photosensitive cathodes) in order to study field emission effects on tube noise.

X-15 Progress Report

On June 22 the X-15 flew to an altitude of 150,000 feet and the hatch was opened for 20 seconds. This was the first test of SAL's X-15 instrumentation under the approximate conditions planned for the later data flights. All four cameras functioned but the buffeting at this relatively low altitude produced some wandering in the stabilized platform. Strong background light overexposed all of the films as we expected from Burkhead's earlier photometry of the uv sky from the X-15.

The next test flight, July 8, aimed at acquiring a specific star with a roll angle of about 30°. The X-15 reached a peak altitude of 210,000 feet on this flight. Again all cameras functioned, but the pilot was not able to hold the desired pointing. During most of the hatch-open time, violent motions in roll and pitch were exposed with each camera. The exposure times for the sequences were 5, 20, 1, 5, and 3 seconds. Strong background light presisted at this higher altitude, as seen by the visual cameras and the three filter cameras centered at 2800, 2500, and 2000 Angstroms.

The July 8, flight also carried a spectrograph to measure the intensity and spectral distribution of the daytime sky. The spectrograph was designed and constructed at SAL, and its optical components consist of a single concave mirror, a plane reflection



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grating blazed at 2000 Angstroms, and a curved holder for a 35-mm film strip. The instrument records the region λ3500-1800 with dispersion of about 80 Angstroms/mm.

Unlike the cameras, the spectrograph makes a single exposure whose length is controlled by the opening and closing of the hatch.

Because the flight of July 8 encountered pointing difficulties, NASA selected arbituary roll and pitch for the next test on August 3. The flight of August 3 reached a peak altitude slightly over 200,000 feet and the hatch was open for 37 seconds. Again the pilot encountered control difficulties. Except for a few seconds during the 20 second expousre, however, the platform maintained a pointing within the planned limit of one minute of arc. Two uv cameras failed to transport film properly, but the λ2800 and visual films were satisfactory except for the amount of background light. Unfortunately the star field observed did not contain stars light enough to detect on the films.

Following this flight Mr. Roland Voith of ACA designed and built a new power supply for the camera transport mechanisms. Since the installation of this power supply we have had no further camera failures.

The spectrograms obtained on July 8 and August 3 did not confirm a bright uv sky. For this reason the flight of September 2 was used to determine whether sunlight scattered in the instrument hatch was responsible for part or all of the background observed with the cameras. For this flight cameras were mounted symmetrically on the platform, with one pair (one visual and one λ2500 camera) on the left and an identical pair on the right side. The flight reached 240,000 feet and achieved the planned, arbituary pointing of zero roll and 8° back pitch. Again the platform performed satisfactorily. Differences in background light as seen from the right and left sides of the platform showed that scattered sunlight did contribute to the film blackening.

On the basis of these three flights (July 8, August 3, September 2) it was decided to postpone future flights for approximately two months to permit building and testing of scattered light traps for the cameras. This requires alterations in the camera mountings, primarily lowering the cameras to gain space for the light traps in the very limited confines of the X-15 hatch. The camera platform and light traps are now under construction at SAL.

Sincerely,

Arthur D. Code

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Principle Investigator

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